Mark schemes

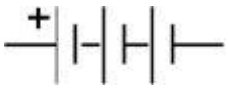
Q1.

(a) correct circuit symbol

1

3 cells joined in series in correct orientation

e.g.



ignore absence of + symbol

1

(b) $R = \frac{12}{1.6}$

1

R = 7.5 (Ω)

1

*an answer of 7.5 (Ω) scores **2** marks*

(c) 4.0 (Ω)

*allow their answer to part **(b)** − 3.5 correctly calculated*

1

(d) it decreases

1

the current would be higher (for the same p.d.)

reason only scores if correct box is chosen

or

more than one path for charge to flow

allow current for charge

or

total resistance is always less than the smallest individual resistance

1

[7]

Q2.

(a) potential difference

allow p.d.
allow voltage

1

temperature

1

in this order only

(b) the current increases (when the potential difference increases)

1

(which) causes the temperature of the filament to increase

1

(so) the resistance increases

*do **not** accept resistance increases and then levels off*

1

(c) a higher proportion / percentage of the (total) power / energy input is usefully transferred

wastes less energy is insufficient

or

higher (useful) power / energy output for the same (total) power / energy input

1

(d) potential difference increases

1

current decreases

1

(e) 1000 (Ω)

reason only scores if R = 1000 (Ω)

1

potential difference is shared in proportion to the resistance

allow a justification using a correct calculation

1

(f) $12 = I \times 7000$

1

$$I = \frac{12}{7000}$$

1

$I = 1.71 \times 10^{-3}$ (A)

*an answer that rounds to 1.7×10^{-3} (A) scores **3** marks*

1

$I = 1.7 \times 10^{-3}$ (A)

this answer only

or

I = 0.0017 (A)

*an answer of 2.4×10^{-3} (A) scores **2** marks*

*if no other marks scored allow **1** mark for calculation of total resistance (7000 Ω)*

1

*an answer of 1.7×10^{-3} (A) scores **4** marks*

[14]

Q3.

(a) current at 0.5 V = 0.91 (A)

1

P = 0.91 × 0.5

1

P = 0.455 (W)

*an answer of 0.455 (W) scores **3** marks*

1

(b) straight line with positive gradient

*allow for **1** mark a straight line that passes through (0.1, 0)*

1

positive y-axis intercept

ignore any values on y-axis

1

(c) $0.15 = \frac{0.52}{\text{total P}}$

1

total P = 3.47 (W)

1

$\text{area} = \frac{3.47}{450}$

1

area = 7.7×10^{-3} (m^2)

*an answer of 7.7×10^{-3} (m^2) scores **4** marks*

allow use of student's calculated incorrect total power for last 2 marking points

1

(d) connect the solar cells in parallel

1

(so that) the current has multiple paths it can take

or

the total resistance is less than the resistance of one solar cell

1

[11]

Q4.

(a) 97 500 = 65.0 × t

1

$t = \frac{97500}{65.0}$

1

t = 1500 (s)

*an answer of 1500 (s) scores **3** marks*
*an answer of 1.5 scores **2** marks*

1

(b) $19.6 = I^2 \times 1.60$

1

$$I^2 = \frac{19.6}{1.60}$$

1

I = 3.5 (A)

allow 1 mark for a correct value for I correctly multiplied by 4

1

current through battery = 14 (A)

*an answer of 14 (A) scores **4** marks*

1

[7]

Q5.

(a) V = 0.10 × 45

1

4.5 (V)

1

(b) R = 12 / 0.10

1

total resistance = 120 (Ω)

1

R = 120 – 105 = 15 (Ω)

1

(c) (total) resistance decreases

1

(so) current increases

1

[7]

Q6.

(a) 20

1

(b) 50

1

(c) (i) 115

1

(ii) 230

1

(iii) if one goes out the other still works

or
brighter

accept power (output) is greater
can be switched on/off independently is insufficient

1

(d) the outside/casing is plastic

there is plastic around the wires is insufficient
it is plastic is insufficient

1

and plastic is an insulator

an answer the light fitting is double insulated gains both marks

1

(e) (residual current) circuit breaker

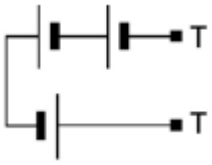
accept RCCB
accept RCBO
accept RCCD
accept RCB
accept miniature circuit breaker / MCB
trip switch is insufficient
breaker is insufficient
do not accept earth wire

1

[8]

Q7.

(a) 3rd box from the left ticked



1

(b) correct symbol drawn in series with other components

symbol must have upper case A

1

(c) (i) 9 + 3 = 12V

reason only scores if this mark scored

1

pd of battery is shared between the variable resistor and fixed resistor

accept $V_1 + V_2$ = pd of the battery
accept p.d. is shared in a series circuit
accept voltage for p.d.

1

(ii) 600

reason only scores if this mark scored

1

p.d. of supply shared equally when resistors have the same value
or
ratio of the p.d. is the same as the ratio of the resistance

1

(iii) 0.015
or
their (c)(i) ÷ (their (c)(ii) + 200) correctly calculated

*allow **2** marks for correct substitution ie 12 = I × 800*

or

their (c)(i) = I × (their (c)(ii) + 200)

*allow **1** mark for total resistance = 800 (Ω) or their (c)(ii) + 200*

or

*allow **1** mark for a substitution of 12 = I × 200*

or

their (c)(i) = I × 200

or

alternative method using the graph

V = 3 V (1)

3 = I × 200 (1)

3

[9]

Q8.

(a) filament bulb

1

(b) (i) 6 V

1

(ii) 3 Ω or their $\frac{(i)}{2}$ correctly calculated

allow 1 mark for correct substitution ie

6 = 2 × R

or their (i) = 2 × R

2

(iii) 1 A

1

(iv) 6 Ω or their (i) / their (iii) correctly calculated

1

(v)

Decrease	Stay the same	Increase
	✓	

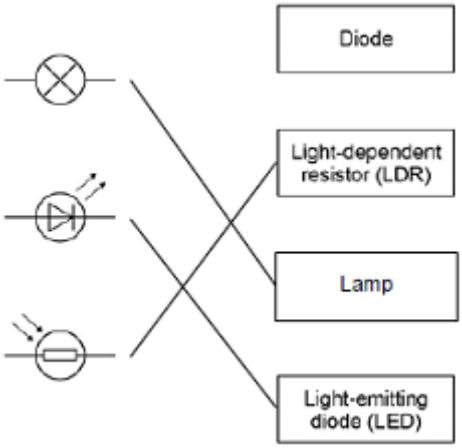
✓		
✓		

1
1
1

[9]

Q9.

(a)



*allow **1** mark for each correct line if more than one line is drawn from any symbol then all of those lines are wrong*

3

(b) (i) half

1

(ii) 3(V)

1

(iii) V_1

1

(c) (i) potential difference / voltage of the power supply

accept the power supply
accept the voltage / volts
accept number of cells / batteries
accept (same) cells / batteries
do not accept same ammeter / switch / wires

1

(ii) bar drawn – height 1.(00)A

ignore width of bar
*allow **1** mark for bar shorter than 3rd bar*

2

(iii) as the number of resistors increases the current decreases

1

[10]

Q10.

(a) 35

*an answer with more than 2 sig figs that rounds to 35 gains **2** marks*

*allow **2** marks for correct method, ie* $\frac{230}{6.5}$

*allow **1** mark for I = 6.5 (A) **or** R =* $\frac{230}{26}$

*an answer 8.8 gains **2** marks*

*an answer with more than 2 sig figs that rounds to 8.8 gains **1** mark*

3

(b) (maximum) current exceeds maximum safe current for a 2.5 mm^2 wire

accept power exceeds maximum safe power for a 2.5 mm^2 wire

or

(maximum) current exceeds 20 (A)

(maximum) current = 26 (A) is insufficient

1

a 2.5 mm^2 wire would overheat / melt

accept socket for wire

*do **not** accept plug for wire*

1

(c) a.c. is constantly changing direction

accept a.c. flows in two directions

accept a.c. changes direction

a.c. travels in different directions is insufficient

1

d.c. flows in one direction only

1

[7]

Q11.

(a) (i) 6

1

(ii) variable resistor

1

(iii) voltmeter

1

(b) (i) point at 3 V ringed

1

(ii) The student misread the ammeter.

1

(iii) 1 (volt)

accept every volt

1

(c) as one increases so does the other
or
directly proportional
or
positive correlation

accept a numerical description, eg when one doubles the other also doubles

1

[7]